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NEW BEDFORD HARBOR  
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#### DECISION CRITERIA

##### New Bedford Harbor Pilot Study

June 22, 1988

#### PURPOSE

Section 4 of the U.S. Army Corps of Engineers report entitled "Pilot Study of Dredging and Dredged Material Disposal Alternatives", dated November 1987, describes how the data acquired through the monitoring program will be used to determine if pilot study operations are causing an unacceptable risk to public health or the environment. Section 4.3.C of the Corps report states that a document would be developed that lists numerical decision criteria.

The purpose of this decision criteria document is to set forth chemical and biological criteria which, if exceeded, would require a decision to be made regarding the suspension, continuation and/or modification of operations. This decision will be made by a decision criteria committee, chaired by EPA, with representatives from EPA's Environmental Research Laboratory, the Massachusetts Department of Environmental Quality Engineering, the Massachusetts Office of Coastal Zone Management, the Corps of Engineers-New England Division and the Corps of Engineers-Waterways Experiment Station.

The Decision Criteria outlined herein are based on the best information available to date and are conservative in nature. The Criteria are intended to serve as an early warning system to the Committee of potential problems requiring a review of project operations and resulting in a

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decision concerning continuation, modification or suspension of those operations. Consistent with the overall developmental nature of the Pilot Study, however, the Decision Criteria will be continuously evaluated and may be adjusted as necessary to reflect the availability of additional analytical data and actual field observations and experience.

#### INTRODUCTION

Decision criteria are required to determine if there are unacceptable releases of contaminants or toxicity to the environment during dike construction, dredging or other activities that are part of the New Bedford Harbor pilot dredging study. If releases exceed numerical decision criteria, the decision criteria committee will evaluate the monitoring data and other information related to the operation and a decision on an appropriate action will be made. Decision criteria cannot be based on existing state or general water quality standards for PCBs, and some metals, because concentrations in water at this site currently exceed standards. In addition, decision criteria cannot be based on accumulation of biologically available PCB concentrations to the 2 ug/g FDA action level in seafood, because PCB concentrations in indigenous organisms presently exceed this level. Finally, decision criteria cannot be based on concentrations of specific chemicals in water or sediments alone, because sediments to be dredged are toxic, and the cause of toxicity may not be related to chemicals monitored. Therefore, both chemical monitoring and tests with marine organisms are required to determine the environmental acceptability of this project.

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Decision criteria for this project are based on pre-operational monitoring which provides data on baseline contaminant concentrations, bioaccumulation and toxicity and their respective variability. These data can then be used to identify a contaminant concentration or biological response that is acceptable in light of pre-existing conditions. These concentrations and responses can then be compared with similar monitoring data collected during operational phases of the project to detect statistically significant or numerically relevant changes that may require a management decision. The decision criteria must reflect the need to accept the risk of short-term moderate increases in the release of contaminants or associated toxicity in the near-field, as long as the goal of long-term clean up is achieved. The procedure for deriving decision criteria must be fixed prior to initiating the project, but numerical values should be flexible to allow incorporation of additional pre-operational monitoring data. Decision criteria should be sufficiently sensitive to permit detection of potentially unacceptable conditions so that the operation can be suspended and if necessary, a decision on an appropriate action can be made. Actions which might be recommended include, but are not limited to, the following: Monitor rates of return to normal, confirm reasonableness of observations using monitoring data from other locations, install additional silt curtains, change dredges, change dredging operational procedures, limit CDF discharge to non-dredging periods or resume dredging.

#### PRE-OPERATIONAL MONITORING

Physical, chemical and biological data, relevant to the derivation of decision criteria, were monitored prior to the operational phase of the project to define baseline contaminant concentrations in water and biota and biological responses to receiving waters (ERL-Narra-

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gansett, 1988). This monitoring focused on stations above the dredging site (NBH-1), at the Coggeshall Street Bridge (NBH-2), north of Popes Island (NBH-3), near the Hurricane Barrier (NBH-4) and at a reference site near West Island (NBH-5).

Although all data on pre-operational conditions should be examined when evaluating the implications of operational phases, baseline data from endpoints and locations pertinent to the decision criteria are most important (Table 1). The first available signal after initiation of an operational phase (2 to 4 hours) should be an increase in suspended solids concentrations. Baseline suspended solids concentrations averaged 8.7 mg/l (coefficient of variation (C.V.) = 44%) during flood tides at NBH 1 and 9.7 mg/l (C.V.=32%) during ebb tide at NBH-2. Total contaminant concentrations in flow-proportional composite samples during ebb tides were 0.64 ug/l (C.V.=42%) for total PCBs, 0.22 ug/l (C.V.=23%) for Cd, 2.7 ug/l (C.V.=31%) for Pb and 5.4 ug/l (C.V.=18%) for Cu. Net transport of PCBs averaged 0.34 kg/tidal cycle (C.V.=50%).

Concentrations of PCBs in mussel tissues were greater near the Coggeshall Street Bridge, 45.7 ug/g (C.V.=21%) on day 7 and 94.7 ug/g (C.V.=18%) on day 28, than at the Hurricane Barrier, 7.1 ug/g (C.V.=49%) on day 7 and 13.7 ug/g (C.V.=21%) on day 28. Variability of all data, except for lead concentration at NBH-4 and mussel scope for growth, were low. Composite water samples from the ebb tide at NBH-2 were not lethal to fish, invertebrates or plants tested. No sublethal responses were measured in waters collected at NBH 4.

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#### DECISION CRITERIA

Decision criteria are based on data from the baseline monitoring study and are intended to: (1) limit transport of contaminants from the upper estuary to the lower harbor and bay, (2) prevent excessive mortalities of species below the upper estuary, (3) limit to the harbor, sublethal biological effects. Numerical decision criteria (Table 2) are intended to be revised as additional pre-operational monitoring data become available. These revised values will become the decision criteria for that operational phase.

Decision criteria adopted by EPA are presented in Table 2. Statistical analyses revealed exceptionally small variation in chemical and biological data (Table 1). Because the critical values were not very different from average baseline conditions, judging the environmental acceptability of the pilot study, based solely on statistically derived critical values, would not be consistent with the need to accept risks of short-term increases in contaminant release or associated toxicity in the near-field. Instead, the decision criteria followed the approach illustrated for chemical concentrations in Figure 1. If monitoring during an operational phase indicates PCB, copper, or lead concentrations increase by  $\geq 5X$  above baseline at any time or by  $\geq 2X$  twice during any operational phase, the decision criteria committee will evaluate the monitoring data and other information related to the operation prior to resumption of the operation. For biological monitoring data, decision criteria are based on effect endpoints that are both biologically meaningful and statistically significant (Table 2). Detection of high mortality or dramatic sublethal effects in one species, or lesser levels of effects in two of the five species tested, will require the decision criteria committee to evaluate

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the monitoring data and other information related to the operation prior to the resumption of operations. Details of specific numerical decision criteria, station locations and decisions required follow.

#### CRITERIA

##### I. TOTAL SUSPENDED SOLIDS:

NBH-1: 53 mg/l - This value is an estimate of the increase in suspended solids from an operational phase that could result in the exceedance of the "one time" decision criteria of 3.2 ug/l of PCBs in the ebb tide at NBH-2. It was calculated using this decision criteria value of 3.2 ug/l, the mean concentration of PCBs in the ebb tide of 0.64 ug/l, the average concentration of PCBs of 117 ug/l in the top foot of sediment in the cove, and the estimate of a 50 percent volume exchange per tidal cycle. Exceedance during the flood tide requires that the decision criteria committee evaluate data on PCB and metals concentrations at NBH-2, other monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-2: 32 mg/l - This value is an estimate of the increase in suspended solids from an operational phase that could result in the exceedance of the "one time" decision criteria of 3.2 ug/l of PCBs in the ebb tide at NBH-2. It was calculated using this decision criteria value of 3.2 ug/l, the mean concentration of PCBs in the ebb tide of 0.64 ug/l and the average concentration of PCBs of 117 ug/l in the top foot of sediment in the cove. Exceedance of this value requires that the decision criteria committee evaluate data on PCB and metals concentrations at NBH-2, other monitoring data and other information related to the operation prior to resumption of operations the next day.

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## II. Total Contaminant Concentrations in Water:

NBH-2: 3.2 ug/l PCBs - This value is 5X the mean concentration observed in ebb tide water samples collected during the pre-operational monitoring. Exceedance of this value requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-2: 1.3 ug/l PCBs, 9.8 ug/l Cu, - These values are 2X the mean concentration observed in ebb tide water samples collected during the pre-operational monitoring at this site. Exceedance of one of these values requires that a sample be collected again. If exceeded twice during the operation, the decision criteria committee must evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-2: 9.3 ug/l Cd, 5.6 ug/l Pb - These values are the Criteria Continuous Concentration (CCC) from the EPA Water Quality Criteria for cadmium and lead. Exceedance either of these values require that a sample be collected again. If exceeded twice during the operation, the decision criteria committee must evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-4: 0.3 ug/l PCBs and 5.4 ug/l Cu - These values are 2X the mean concentration observed in ebb tide water samples collected during the pre-operational monitoring at NBH-4. Exceedance of this value requires that a sample be collected again. If these values are exceeded twice during the operation and if concentrations are significantly elevated at NBH-2, the decision criteria committee must evaluate monitoring data and other information related to the operation prior to resumption of

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operations on the next day.

NBH-4: 9.3 ug/l Cd and 5.6 ug/l Pb - These values are Criteria Continuous Concentrations from the cadmium and lead water quality criteria documents. If these values are exceeded twice during the operation and if concentrations are significantly elevated at NBH-2, the decision criteria committee must evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

### III. Net Transport of PCBs:

NBH-2: 1.7 kg/tidal cycle - This value is 5X the mean net transport of PCBs observed at NBH-2 during pre-operational monitoring. Exceedance of this value requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

NBH-2: 0.7 kg PCBs/tidal cycle - This value is 2X the mean net transport of PCBs observed at NBH-2 during pre-operational monitoring. Exceedance of this value twice during any operation requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of operations on the next day.

### IV. Bioaccumulation in Mussels:

NBH-2: 90 ug/g PCBs on day 7 or 190 ug/g PCBs on day 28 - These values are 2X the mean concentration observed in mussel samples collected during the pre-operational monitoring. Exceedance of one of these values requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the next phase of operation.

NBH-4: 14 ug/g PCBs on day 7 or 27 ug/g PCBs on day 28 - These values are 2X the mean concentration observed in mussel samples collected during

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the pre-operational monitoring. Exceedance of one of these values requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the next phase of the operation.

V. Organism Responses - Mortality:

NBH-2:  $\geq 20\%$  mortality (or  $80\%$  fertilization for sea urchins) for two species or  $\geq 50\%$  mortality (or  $\geq 50\%$  fertilization for sea urchins) for one species - The value of  $80\%$  survival ( $20\%$  mortality) was selected as the level of significant biological impact for each species and  $50\%$  mortality as representing an imminent threat to one species. Exceedance of  $20\%$  mortality for two species or  $50\%$  mortality for one species requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the operations on the next day.

VI. Organism Responses - Sublethal Impacts:

NBH-4: Values for significant sublethal impacts on growth or reproduction are species specific and represent magnitudes of impact of probable long-term significance to local populations (Table 2). Exceedance of these values for two species or 2X these values for any one species at NBH-4 and occurrence of similar or more severe responses for the same species at NBH-2 requires that the decision criteria committee evaluate monitoring data and other information related to the operation prior to resumption of the next phase of the operation.

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Table 1. Results of the pre-operational monitoring efforts for the New Bedford Harbor Pilot Project. Data shown for each station and endpoint include the mean, the coefficient of variation (%), the statistically significant critical value (underlined), and the number of samples used to calculate the mean (n). Chemical data were transformed using logarithms and survival data using arcsines to normalize distributions prior to calculation of means, variances, and critical values. The numbers in brackets next to the values for the biological responses are the mean values at the West Island control station (NBH-5) for that endpoint. Only values from stations and endpoints used in the Decision Criteria are listed. (These baseline data will be changed as a result of additional preoperational monitoring.)

| New Bedford Harbor Station Location |                                |   |  |                                |
|-------------------------------------|--------------------------------|---|--|--------------------------------|
| Endpoint                            | Above Cove<br>(NBH-1)          | Coggeshall St.<br>Bridge<br>(NBH-2)         | Hurricane<br>Barrier<br>(NBH-4)                  |                                |
| Water                               |                                |   |  |                                |
|                                     | Flood                          | Ebb   |  |                                |
| Suspended Solids (mg/l)             | 8.7, 44%<br><u>16.4</u> , (8)  | 9.7, 32%<br><u>15.7</u> , (9)               |  |                                |
| Water Chemistry                     |                                |   |  |                                |
|                                     | Ebb (ug/l)                     | Ebb-Flood (ug/l)                            | Net Transport (kg)                               | Ebb (ug/l)                     |
| PCB                                 | 0.64, 42%<br><u>0.94</u> , (7) | 0.12, 50%<br><u>0.24</u> , (7)              | 0.34, 50%<br><u>0.70</u> , (7)                   | 0.13, 14%<br><u>0.23</u> , (6) |
| Cd                                  | 0.22, 23%<br><u>0.46</u> , (7) |   |  | 0.13, 27%<br><u>0.42</u> , (7) |
| Pb                                  | 2.7, 31%<br><u>5.2</u> , (7)   |   |  | 1.9, 88%<br><u>5.8</u> , (7)   |
| Cu                                  | 5.4, 18%<br><u>10</u> , (7)    |   |  | 2.7, 24%<br><u>4.6</u> , (7)   |
| Mussel PCB Tissue Residues (ug/g)   |                                |   |  |                                |
| 7-day exposure                      |                                | 45.7, 21%<br><u>65.7</u> , (7)              |  | 7.1, 49%<br><u>14.3</u> , (7)  |
| 28-day exposure                     |                                | 94.7, 18%<br><u>131.9</u> , (6)             |  | 13.7, 21%<br><u>19.7</u> , (7) |
| Biological Responses                |                                |   |  |                                |
| Acute (% Survival)                  |                                | Ebb   |  |                                |
| Fish                                |                                | 88, 6%, <u>75</u> , (6)<br>[93, 11%, (6)]   |  |                                |
| Myxids                              |                                | 100, 0%, <u>100</u> , (8)<br>[99, 15%, (8)] |  |                                |
| Mussels *                           |                                | 95, 25%, <u>22</u> , (5)<br>[99, 14%, (7)]  |  |                                |
| Sea Urchins (% Fert.)               |                                | 93, 48, <u>87</u> , (12)<br>[94, 3%, (11)]  |  |                                |
| Plants                              |                                | 100, 0%, <u>100</u> , (2)<br>[100, 0%, (2)] |  |                                |
| Chronic Effects                     |                                |   | Ebb  |                                |
| Fish (dry wt., mg)                  |                                |   | 1.22, 11%, <u>0.32</u> , (6)<br>[1.10, 7%, (6)]  |                                |
| Myxids (dry wt., mg)                |                                |   | 0.285, 7%, <u>0.23</u> , (8)<br>[0.290, 7%, (8)] |                                |
| Mussels: *                          |                                |   | 1.3, 174%, <u>2.3</u> , (4)<br>24%, 0.50%, (2)   |                                |
| Scope for growth (J/h) **           |                                |   |  |                                |
| Shell growth (mm) ***               |                                |   |  |                                |
| Sea Urchin (% Fert.)                |                                |   | 93, 5%, <u>85</u> , (12)<br>[94, 3%, (11)]       |                                |
| Plant (% cystocarps) ****           |                                |   | 17.5, 29%, <u>8.7</u> , (30)                     |                                |

\* Mussels were deployed continuously in the field, therefore, any biological responses reflect the integrated effect of both the ebb and flood tides.

\*\* The absolute value of this index can vary throughout the year, therefore, it is used as a relative measure. The value in this table reflects the difference in the endpoint between stations NBH-4 and NBH-5.

\*\*\* The absolute shell growth of mussels changes throughout the year. The values shown are the mean coefficient of variation (%) of shell growth for the two deployments, the critical value (%) in mean growth between the NBH-4 and NBH-5 stations, and the number of deployments (n).

\*\*\*\* Values shown are representative of the response of control treatments in tests with this species conducted over the past year.

Table 2. Monitoring program endpoints and the numerical decision criteria requiring temporary or permanent cessation of any operational phase or an increase in sampling or sample processing. (These numerical decision criteria will be revised as additional preoperational monitoring data become available.)

New Bedford Harbor Station Location

| Endpoint                          | Time to obtain first value | Above Cove (NBB-1) | Coggeshall St. Bridge (NBB-2)  | Hurricane Barrier (NBB-4)   |         |
|-----------------------------------|----------------------------|--------------------|--|-----------------------------|---------|
| Water                             |                            |                    |  |                             |         |
| -----                             |                            |                    |  |                             |         |
|                                   |                            | Flood              | Ebb  |                             |         |
|                                   |                            | -----              | -----  |                             |         |
| Suspended solids (mg/l)           | 2-4 hr                     | 53                 | 32   |                             |         |
| Water Chemistry                   |                            |                    |  |                             |         |
| -----                             |                            |                    |  |                             |         |
|                                   |                            |                    | Ebb (ug/l) Net Transport (kg)  | Ebb (ug/l)                  |         |
|                                   |                            |                    | -----  | -----                       |         |
| PCB (total)                       | 24 hr                      |                    | 3.2 *<br>1.3 **  | 1.7/cycle *<br>0.7/cycle ** | 0.3 **  |
| Cd                                | 24 hr                      |                    | 9.3 ***  |                             | 9.3 *** |
| Pb                                | 24 hr                      |                    | 5.6 ***  |                             | 5.6 *** |
| Cu                                | 24 hr                      |                    | 9.8 **   |                             | 5.4 **  |
| Mussel PCB Tissue Residues (ug/g) |                            |                    |  |                             |         |
| 7-day exposure                    | 10 days                    |                    | 90 *   |                             | 14 *    |
| 28-day exposure                   | 30 days                    |                    | 190 *  |                             | 27 *    |
| Biological Responses              |                            |                    |  |                             |         |
| Acute (% Survival)                |                            |                    | Ebb  |                             |         |
| -----                             |                            |                    | -----  |                             |         |
| Fish                              |                            |                    |  |                             |         |
| Mysids                            | All tests monitored daily  |                    | Mortality > 20% of Control value for two species or > 50% for one species ** |                             |         |
| Mussels                           |                            |                    |  |                             |         |
| Sea Urchins (% Fert.)             |                            |                    |  |                             |         |
| Plants                            |                            |                    |  |                             |         |
| Chronic Effects                   |                            |                    |  | Ebb ****                    |         |
| -----                             |                            |                    |  | -----                       |         |
| Fish (dry wt., mg)                | 8 days                     |                    |  | 20% (40%)                   |         |
| Mysids (dry wt., mg)              | 8 days                     |                    |  | 20% (40%)                   |         |
| (reproduction)                    |                            |                    |  | 50% (100%)                  |         |
| Mussels:                          |                            |                    |  |                             |         |
| Scope for growth (J/h)            | 8 days                     |                    |  | 7.5 J/h (15 J/h)            |         |
| Shell growth (mm)                 | 28 days                    |                    |  | 50% (100%)                  |         |
| Sea Urchin (% Fert.)              | 1 day                      |                    |  | 25% (50%)                   |         |
| Plant (% cystocarps)              | 8 days                     |                    |  | 50% (100%)                  |         |

\* This value requires that the decision criteria committee evaluate the monitoring data, and other information related to the operation, prior to resumption of operations on the next day.

\*\* This value requires that the sample be collected again. If exceeded twice for an individual species, the decision criteria committee must evaluate the monitoring data, and other information related to the operation, prior to resumption of operations on the next day.

\*\*\* U.S EPA water quality criterion; criteria continuous concentration.

\*\*\*\* This value represents a statistically and biologically significant reduction from control values. A significant reduction in two endpoints, or a 2X reduction in one endpoint (in parentheses), requires that the decision criteria committee evaluate the monitoring data, and other information related to the operation, prior to resumption of operations on the next day.

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# NEW BEDFORD WEATHER OBSERVATIONS

The following weather observations were collected by the City of New Bedford Department of Public Works and provided by Mr. Leon Halle, Supervising Civil Engineer.

## JULY

| TEMP |     |      |    | PRECIP.              |
|------|-----|------|----|----------------------|
| MAX  | MIN | 0800 |    |                      |
| 1    | 86  | 66   | 66 |                      |
| 2    | 77  | 63   | 68 | RAIN .52"            |
| 3    | 78  | 60   | 61 | RAIN/DRIZZLE .12"    |
| 4    | 82  | 66   | 67 | DRIZZLE/FOG Trace    |
| 5    | 82  | 64   | 71 |                      |
| 6    | 80  | 61   | 68 | CLEAR                |
| 7    | 76  | 58   | 62 | CLEAR                |
| 8    | 73  | 64   | 66 | CLOUDY               |
| 9    | 87  | 66   | 69 | AM FOG/CLDY/HAZY     |
| 10   | 90  | 68   | 78 | AM FOG/CLR/HAZY      |
| 11   | 82  | 68   | 70 | AM FOG/HAZY          |
| 12   | 75  | 68   | 70 | AM FOG/OVERCAST      |
| 13   | 74  | 68   | 68 | RAIN/DRIZZLE .01"    |
| 14   | 77  | 70   | 72 | FOG/SHOWERS/TS Trace |
| 15   | 83  | 67   | 70 | DRIZZLE/CLEAR Trace  |
| 16   | 78  | 62   | 65 | CLOUDY               |

8 days  
0.74 inches

SAMPLING PERIOD

MONTH TOTAL 1.13"

## SEPTEMBER

| TEMP |     |      |    | PRECIP.            |
|------|-----|------|----|--------------------|
| MAX  | MIN | 0800 |    |                    |
| 13   | 70  | 64   | 65 | HEAVY RAIN 1.26"   |
| 14   | 81  | 64   | 70 | RAIN .16"          |
| 15   | 79  | 56   | 58 |                    |
| 16   | 80  | 60   | 61 |                    |
| 17   | 76  | 65   | 68 | RAIN .23"          |
| 18   | 65  | 55   | 60 | SHOWERS .28"       |
| 19   | 59  | 56   | 56 | SHOWERS .72"       |
| 20   | 61  | 55   | 58 | RAIN 1.36"         |
| 21   | 63  | 54   | 54 | MIST .03"          |
| 22   | 72  | 57   | 58 | CLOUDY             |
| 23   | 72  | 54   | 54 | CLDY/CLR           |
| 24   | 77  | 58   | 58 | CLR/CLDY/RAIN .03" |
| 25   | 67  | 49   | 50 | CLEAR              |
| 26   | 68  | 46   | 49 | CLEAR              |
| 27   | 68  | 49   | 49 | CLEAR              |
| 28   | 73  | 55   | 61 | CLEAR              |
| 29   | 77  | 61   | 63 | CLEAR              |
| 30   | 71  | 63   | 66 | SHOWERS .27"       |

10 days  
4.04 inches

SAMPLING PERIOD

MONTH TOTAL 5.49"